

2017 GROUNDWATER STATUS REPORT

The Iowa Department of Natural Resources (DNR) is providing this report in fulfillment of Section 455B.263(1) of the Iowa Code, which states:

The commission shall deliver to the general assembly by January 15, 1987, a plan embodying a general groundwater protection strategy for this state which considers the effects of potential sources of groundwater contaminations on groundwater quality. The plan shall evaluate the ability of existing laws and programs to protect groundwater quality and recommend any necessary additional or alternative laws and programs. The department shall develop the plan with the assistance of and in consultation with representatives of agriculture, industry, and public and other interests. **The commission shall report to the general assembly on the status and implementation of the plan on a biennial basis.** This section does not preclude the implementation of existing or new laws or programs which may protect groundwater quality.

This report is intended to serve as the current report on the status of groundwater in Iowa. It focuses on the water supply, or “water quantity” work of the DNR and its partners, and briefly summarizes the status of Iowa’s groundwater supplies. It also summarizes a review of DNR water allocation policy.

Background: The 2007 Strategy for Managing Iowa’s Water Resources

Accurate and up-to-date information about the quality and quantity of Iowa’s water resources is vital to the State’s ability to meet the needs of its citizens, and to sustain the ecological functions of streams fed by groundwater, especially during droughts. It is critical to attracting industries with large water demands that need assurance the well won’t run dry. A review conducted in 2007 concluded that Iowa’s knowledge base and tool-box for assessing groundwater was inadequate and out-of-date. *Aquifer Characterization* studies, which integrate information such as hydrologic properties, response to pumping, and groundwater levels with the physical geologic framework of key units had not been updated for 20-40 years, and new tools, such as *Predictive Models*, had not been developed. The Water Allocation program, charged with reviewing requests for water use permits, was inadequately funded, and could provide only cursory review of many permits. Permit fees for water use had remained at \$25 for 10 years. There were limited resources for acquisition of new information, such as aquifer tests or strategic monitoring wells. Groundwater level monitoring had ended, because of budget constraints. While there were concerns about the effects of long-term pumping on our deep aquifers, and the adequacy of our shallow aquifer-stream systems to meet increased demands during drought, the state was lacking in the information and methods needed to assess the risks or provide guidance to avoid them. Iowa also lacked the database capabilities to efficiently bring together available groundwater data, a fact that slowed and sometimes limited our assessment of groundwater.

In response to this review, DNR and a group of partners and water interests developed a Strategy for the Management of Iowa's Water Resources in 2007. The development of the strategy occurred over a six month period. As completed, the strategy identified 4 goals and 9 actions to meet the goals. In summary, these are:

Goal 1: Characterize Iowa's surface and groundwater resource availability, quality, use, and sustainability.

Actions:

- Characterization of water resources - The characterization of Iowa's water resources requires analysis of geologic materials and data from wells to establish the 3-dimensional physical map of geologic units for the state. For shallow aquifers this will also require characterization of the stream-aquifer systems that carry water, their low-flow characteristics, and interactions between precipitation, surface water, and groundwater.
- Targeted water resource data collection – Collect detailed information, such as test drilling, geophysical profiles, pump tests and water level responses, and groundwater quality and age determinations, where necessary.
- Groundwater level measurements – Quarterly-to-continuous measurements at ~300 wells distributed state-wide.
- Increased stream gauge locations – There are currently about 130 stream gauges in operation in Iowa. To address low-flow information needs, construct and operate 12 additional stream gauge locations.
- Maintenance of aquifer characteristics – Information on the geology and water yielding potential of our aquifers continues to grow. New information must be collected and entered into a database as it becomes available, allowing for up-to-date characterizations.

Goal 2: Identify and estimate water use and the impact on water sources.

Actions:

- Develop predictive models – Water use can be estimated from permit records, although it was realized database improvements were needed. Predictive models take current or estimated future water use, along with aquifer characterizations, and can forecast aquifer impacts into the future – an ability to allow sustainable allocations.
- Maintenance of predictive models - As characterizations, water use estimates, and water level information are updated, models must also be updated.

Goal 3: Make necessary policy recommendations for the sustainable use of Iowa's water resources.

Action:

- Policy review - Working with stakeholders and technical partners, a review of existing authorities and policy will be conducted as they relate to water use and allocation.

Goal 4: Implement a comprehensive, real-time water resource permitting, management, and development system.

Action:

- Water allocation permitting - The products of the other goals/actions will be utilized by the water allocation program to improve water use permitting, both in quality of reviews and in process time. Additional staff is needed to more adequately review the permitting of agricultural drainage wells, and aquifer storage and recovery. Planning activities, such as water conservation planning and implementation, review and update of emergency procedures and drought plans need a more proactive approach by the DNR.

The 2007 strategy was broad and ambitious. The estimated cost of the work was \$3M annually, about the cost of supplying each resident of the state one bottled water each year, a modest price to assure sustained and dependable water supplies for Iowa's communities, businesses, and farms. Funding for the work was less than one-third of that planned. Funding includes \$495,000 annually in Environment First funds, and increased fees for water allocation permits, with the Water Allocation program allowed to keep up to \$500,000 in fees annually to run the program; fees have typically raised about \$350,000 per year.

What was accomplished: 2007 – 2017

While full funding for the actions outlined in the strategy was not obtained, significant resources were made available for addressing the state's water supply needs. These include:

--Aquifer studies and/or models – The main efforts conducted with funding from Environment First appropriations have been the geologic characterization of major aquifers, and the development of predictive models for those with sufficient data. The aquifers that were addressed and dates the work was done are:

Aquifers that were modeled:

- Dakota Sandstone - NW Iowa – 2008

- Jordan Aquifer - Statewide – 2009
- West Nishnabotna alluvial-stream system – 2010
- Des Moines alluvial-stream system - Palo Alto Co – 2011
- Silurian Aquifer – EC Iowa – 2011
- Mississippian Aquifer - NC Iowa – 2012-3
- Lower Raccoon River – alluvial-stream system – 2013

In addition, the model for the critical Jordan Aquifer was updated in 2013. The initial work on the Jordan indicated significant and increasing water level declines in several locales, resulting in a more focused analysis and an update to the model.

Aquifers that were studied but not modeled:

- Rock River alluvial-stream system – 2012-3
- Floyd River alluvial-stream system – 2012-3
- Ocheyedan River alluvial-stream system – 2014
- WC and SW IA – Dakota and buried sand and gravel aquifers: exploration and initial characterization – 2015
- Devonian - upper Ordovician aquifer in NC Iowa, an area with increasing irrigation and industrial demand - 2016

--Database Integration

Bringing together data from different sources and databases is key for the water supply industry and DNR staff in assessing groundwater and making efficient, sound decisions when developing groundwater. Many databases hold information, the legacy of individual state and federal programs needing their own system in the past. While resources were not specifically allocated to this task, several key databases now “speak to each other” in a significantly improved fashion. These include SDWIS, the EPA Safe Drinking Water Act database; GeoSam, the Iowa Geological Survey (IGS) geologic and well database, and Public Wells, DNR-Water Supply’s database of all public water wells. In addition progress has been made in connecting the Water Use database to the others as well.

--Water Allocation program

–Legislation was also passed to allow increased fees for water use permits, with the fees dedicated to the Water Allocation program (total not to exceed \$500,000). Typically the

amount collected by fees has been about \$350,000. In addition to adding resources to more fully and efficiently review water use requests, the funds have been used to develop a water use database. While a water use database has been in existence since the 1970's, upgrades were initiated as a result of external stakeholder process review and requests. The application was moved to production on September 20, 2011. A further phase of the project is underway. Various process improvements for permitting, reporting, and fee collection, affecting approximately 4,000 permittees, have been made. These improvements will create time and money savings for both permittees and DNR staff. Improvements include:

- Electronic submittal of yearly usage reports.
- Incorporation of hydrogeologic reports.
- Minimization of manual paper/digitization processes to allow permittees to enter on-line information in an edited format thereby improving data quality.
- Streamlining workflow and data processes.
- Facilitation of the passage of information electronically to and from the general public, permittees, industry members, organizations, government agencies, DNR field and central office staff, politicians, etc. in a timely manner.
- Public access 24/7 to permit information.
- Improvement in data integrity.

In addition, the Aquifer studies and models funded by the Environment First appropriation have been used to improve the permit, planning, and conflict resolution process for both the allocation program and the regulated community.

--Policy Review – DNR staff and a group of external technical experts and water interests reviewed and made recommendations for changes to DNR's water allocation rules and policies in 2010. This is discussed at the end of this section.

Service to Iowans.

The water quantity program over the last 8 years has produced significant benefits to the people of the state. Dozens of communities and industries have requested model simulations of planned groundwater development or expansion, to assure their plans will deliver the needed water well into the future. Water disputes have been investigated and typically resolved to the satisfaction of all parties. And when the drought of 2012-3 settled into western Iowa, which is characterized by shallow, drought-susceptible aquifers, program staff and products assisted numerous communities and rural water districts to make ends meet.

A major outcome of the program was to bring focus to water-level declines within the Jordan Aquifer, particularly in high-use areas such as Linn, Johnson, and Webster counties. Rules for water-level declines for the Jordan have been in place since the 1970's; while these

rules did place limits of declines, they were based on the science at the time, and contained language making their use problematic. The new information and model approaches allowed for various future water-use scenarios to be evaluated, as well as the effects of possible rule changes on current users. A reasonable approach was developed with stakeholders, one that allows Jordan users to readily assess their status with respect to allowable declines. These rules went into effect in the fall of 2015.

What is Yet to be Done

Specific items identified in the 2007 strategy but that have not been accomplished include:

Aquifer Characterization and Modeling. A variety of aquifers have yet to be assessed. These include, but are not limited to:

--Shallow-rock aquifers in eastern Iowa. These are productive units, often with varying degrees of karst development. They are important water sources and major contributors to stream baseflow, and typically are very vulnerable to contamination. The fractured nature of the rocks and presence of karst development suggests these aquifers are more likely candidates for hydrogeologic characterization rather than regional modeling. They include:

- Devonian-age carbonate strata in north-central Iowa, including the upper Cedar River Watershed.
- Silurian carbonate strata in eastern Iowa (outside of the original model area).
- Cambro-Ordovician carbonate and sandstone strata in northeast Iowa (outside the original model area).
- Mississippian carbonates in southeast Iowa (outside the original model area).

--Unstudied Alluvial Aquifers. Many alluvial systems, particularly in western Iowa, where they are often the only currently-predictable local sources of groundwater, have yet to be assessed or modeled. Those with the greatest drought susceptibility are logical priorities. An additional unstudied aquifer is the Missouri River alluvium, a thick and highly productive sand and gravel sequence underlying the broad Missouri floodplain. This aquifer represents a water source which may significantly increase in importance to western Iowa. Similarly an assessment of the Mississippi River alluvium would also be of value.

Other western Iowa alluvial systems would include:

1. Little Sioux River alluvium (south of Spencer)
2. Boyer River alluvium
3. East Nishnabotna River alluvium
4. Big Sioux River alluvium

Targeted Water Resource Investigations are not funded. Aquifer assessments and updates benefit from targeted data collection, including pump tests at critical locations, the construction of observation wells, in-depth geologic analysis, and groundwater age-dating. These work items, focused where existing data is lacking, add key details to the aquifer studies. The program has partnered with other state and federal programs to accomplish these tasks. Source Water Protection and Geologic Mapping programs are key examples of this leveraging of resources.

Groundwater Level Monitoring. There has not been funding allotted to re-establish groundwater level monitoring. Staff efforts have accomplished occasional rounds of level monitoring, but not with the frequency desired. Ongoing tracking of water levels in aquifers is a needed component to assess the accuracy of model assessments and identify problem areas. The recent drought has raised the need to expand this concept to include water table and soil moisture monitoring to a groundwater level network, which would also act as an early warning system for floods.

Maintenance of Aquifer Characteristics and Models. Additional funds were not allocated to more efficiently process well sample materials and logs and update databases. One model has been updated and others will need to be in the near future.

Water Use Estimates by Aquifer and Use Sector. A significant gap in the information gathering has been the lack of resources to assess groundwater use by aquifer and by use type (i.e., municipal, industrial, irrigation, power generation).

Status of Iowa's Groundwater

The results of aquifer studies, models, and trends in allocation and drought-related problems help to define the current status of our groundwater resource from a quantity point of view. A review of conditions by DNR and IGS hydrogeologists and engineers in late 2016 made the following recommendations on the resources status and management needs for several key groundwater sources:

- **Jordan Aquifer:** Water level declines into the future have been forecast into the future for the Jordan Aquifer, prompting a re-write of the rules for the aquifer. The areas of major use and declines in Webster and Linn-Johnson counties, which were designated Protected Source Areas under the new rule. A detailed review of water levels and withdrawal trends was carried out in these areas to refine modeling and management.
Increasing withdrawals and the addition of Aquifer Storage-Recovery wells is making for a more complex situation across the greater Des Moines area. DNR is refining a model for the Jordan in the area. Consideration might be given to designating it a Protected Source Area in the future.

- **Dakota Aquifer:** Minor localized drawdowns occur, notably around Cherokee, Storm Lake, and Lamars. Overall demand on the aquifer is low relative to productivity, and isn't causing large-scale water level declines. While prediction is difficult, it seems that only a *major* shift towards irrigation would significantly change this. A consensus view is that no particular management/guidance/policy changes are needed for the Dakota. The aquifer can be managed with standard permit processes
- **Silurian Aquifer:** This aquifer is widely used in east-central Iowa. The Silurian in this area IA is similar to the Dakota in that there are localized issues, but no system-wide declines in water levels. The situations differ in that the Silurian rocks outcrop and are recharged relatively nearby, giving more long-term confidence that overall water levels will remain somewhat stable. On the other hand, the much larger population and growing demand suggest localized well interference and drawdowns will increase. Note that some of the future demand is linked to the limits placed on the Jordan, as the Silurian is the main alternative to increasing withdrawals from the Jordan.

The recommendation is that no management/guidance/policy changes are needed for the Silurian. The aquifer can be managed with standard permit processes. However increased demand and water levels should be monitored and the situation reviewed annually.

- **Western Iowa Alluvial Aquifers and RWS:** In contrast to the confined regional bedrock aquifers listed above, the alluvial aquifers used in W IA are recharged locally by precipitation and interact with stream flow. Therefore, they don't face the potential for long-term water-level declines that have occurred in the Jordan aquifer. They are however drought susceptible, and supply numerous RWS which, in turn, supply many livestock operations. During hot drought conditions demand peaks and livestock operations use a significant percentage of the supply, greater than 75% for some systems. Under those conditions, there is little opportunity for conservation or water restrictions. In 2012-13 some RWS were close to major shortfalls.

While there have been sometimes contentious conflicts between users in these aquifers, the drought threat seems the most important to address. Currently, DNR is giving increased attention to new construction and viability assessments to these systems, and IGS is working with several systems to augment wellfield production. However consideration should be given to placing further emphasis on the need for drought planning. A planning standard might utilize a concept like assuring resilience to the "20-year or 50-year" drought, similar to flood protection.

Policy Review

DNR staff and a group of external technical experts and water interests reviewed and made recommendations for changes to DNR's water allocation rules and policies. This review, "Water Rights and Allocation", was completed in 2010 and is available at:

<http://www.iowadnr.gov/Environment/WaterQuality/IowaWaterPlan.aspx> As many of the recommendations would require significant staff time and resources, there has been no action taken on many of the recommendations to date. In 2014 DNR management and water allocation staff reviewed the recommendations and developed a basic prioritization of the recommendations. The original recommendations and their status following the 2014 review are listed below.

- 1) Maintain the DNR's authority and principles of water management established by the current Code of Iowa.

This recommendation was a general confirmation of support for current code authority and the scope and direction of Iowa's water allocation program.

- **Status: Accomplished.**

- 2) Add a definition of sustainability to the Iowa Administrative Code (567 Iowa Administrative Code (IAC) 50.2) as a guiding principle of resource management.

The 2014 review found little compelling reason for this change, given current code language.

- **Status: No action needed**

- 3) Establish rules that define water allocation priorities to guide the allocation process patterned after the existing drought rules.

Currently there are no priorities for actual allocations, although the drought priorities function as such. It was recommended that the current drought priorities with minor modification would best serve this purpose. This recommendation also would add private wells and water-fed ecosystems to the allocation considerations, given that springs, wetlands, coldwater streams and other ecosystems don't have the option of finding an alternative water source.

- **Status: Allocation priorities should be developed.**

- 4) Change emergency shortage priorities listed in 567 IAC 52.10(3) to potentially exclude water conveyed across state boundaries, and to include the use of water for open loop (geothermal) heating and cooling and for the irrigation of any specialty crop including tee and green areas of golf courses.

Only minor changes to the existing priorities were recommended.

- **Status: Low priority for action.**

- 5) Encourage local responses to water shortages by requiring public water supplies to include provisions for restricting consumptive water use in their emergency conservation plans to be implemented during transient drought and water shortage conditions.

Most public water supplies have such conservation plans. DNR currently lacks staff and resources to evaluate or review the plans.

- **Status: Deserves further review and consideration.**

- 6) Promote water conservation. The committee recognized that the need for formalized water allocation can be minimized by increasing voluntary long-term water conservation which will require active engagement of a wide variety of partners.

Water conservation is as obvious tool in water supply management, and promoting it is inherent in water allocation. Promoting long-term, ongoing conservation would be difficult with “water rich” supplies, as they perceive little benefit. More effective conservation efforts would require increased staff and resources.

- **Status: Deserves further consideration.**

- 7) Improve the effectiveness of “Protected Flow” management by convening a scientific panel to assess statistical methods of evaluating flows, review flow thresholds given recent biological research, consider expanding flow thresholds to additional water resources, draft potential rule amendments, and make recommendations for implementing enforcement.

There are many reasons to take a look at protected flows. There are many natural resource, ecosystem, and aquatic life implications, and greatly increased knowledge of them over the last 50 years. Further, we know a number of things have changed since the protected flows were first set. Stream low flows have generally increased, and wastewater treatment has improved. At the same time, stream water quality standards have tightened. This all has implications for protected low-flows

- **Status: Deserves internal technical review.**

- 8) Explore the use of “Protected Water Source” designations to better protect resources such as springs, fens, coldwater streams, wetlands or other water bodies that could be threatened by nearby water development.

Protected Water Source designation would be a potent tool for water body protection, but it is also an intensive process to undertake. Protection for water

bodies might be more readily achieved under recommendation 3, incorporating protections into the allocation process.

- **Status: No further action.**

- 9) Draft changes to 567 IAC Chapter 52 so that all open-loop geothermal heating-cooling systems requiring permits will re-inject, unless it is determined by the DNR that sustainability of the resource is protected with the use of a discharging open-loop system.

- **Status: This has been implemented using existing authority.**

- 10) Develop an internal committee to consider the issue of injecting waters into aquifers for various purposes and to develop coherent policy.

Iowa has fairly strict rules regarding injection of waste or pollutants into groundwater. There has been little impetus to change this, although stricter stream discharge rules could change that. There are deep groundwater zones in the state with poor natural water quality where some kinds of injection could be accomplished with little risk to the resource. The recommendation was to study the issue internally to assess the feasibility and interest.

- **Status: Needs Discussion.**

- 11) Further examine issues of interbasin transfers and interstate transfers and formulate policy. Iowa needs to define the State's interests and beneficial uses for Missouri River waters.

There are a variety of water transfer issues that state has no policies on; these should be examined. A priority for the long-term is the Missouri River, and what upstream diversions from the River means for Iowa's water interests. The relationship between the Missouri alluvial aquifer and stream flows is a key consideration.

- **Status: Needs Study**

SUMMARY

This report briefly summarizes the status of our groundwater in terms of quantity, and the DNR's water-quantity related activities over the past 8 years. If current appropriation levels continue, we anticipate continuing the study and model development for 1-2 major unstudied aquifers or other investigations each fiscal year. In addition, some of the earlier studies will be assessed for the need for updates. It is anticipated updates will be needed.

Developing a groundwater level monitoring network and a process for routinely generating water-use estimates by aquifer and use sector remain priorities that would require additional resources to properly implement.

The Water Allocation program will continue the refinement of the Water Use database and its integration with other data-holding programs.

Further action on items identified in the Policy Review remains under discussion within the DNR. Some of the recommendations, while viewed useful for managing the resource, would require relatively significant staff time and resources to develop and implement, and their value must be weighed against other DNR priorities and resource constraints.

Further actions on management needs for specific aquifers remain under review as well, given the above constraints.